

LEGISLATOR TECHNOLOGY ADOPTION AND PRESENTATION OF SELF THROUGH TWITTER

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ABSTRACT

JOHN G. CLUVERIUS: Legislator Technology Adoption and Presentation of Self Through
Twitter
(Under the direction of Virginia H. Gray.)

The social networking service Twitter has become increasingly popular amongst members of congress as well as ordinary citizens. In this paper, I explore and define theories to explain why state legislators choose to use Twitter, and why they do not. Using three different analyses, I explore twitter adoption at the state and legislator level, as well as analyzing the content of individual Twitter messages. The conclusions are a mixed bag; while I find some evidence of the effects of professional staff on Twitter adoption in states, this does not translate to the individual level. While it is clear that home style messages make up a sizeable portion of state legislator Twitter messages, there is no clear pattern to predict why or how legislators are more or less likely to use different types of Twitter messages.

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Introduction

Twitter offers scholars of political communication and the role of information technology in politics a particular opportunity in exploring issues of legislator behavior, citizen-official communication, and public opinion. Political scientists and other scholars are able to observe the evolution of a new medium as it develops and increases in saturation or becomes extinct. The meticulous nature of research makes it difficult to attune itself to rapidly-changing technology. At the same time, research presents a grander question of technology's impact on American politics and its processes. This question has both positive and normative implications. When a new technology arises, it can be merely a new tool of communication, or can bring meaningful change to participation, representation, and other normative democratic concerns. Political scientists should also be concerned as to whether the same theories of institutional and behavioral processes that have been developed in the discipline are relevant to a new technological medium. While it is unlikely that a new technology will fundamentally alter the theoretical perspectives, it is helpful to examine how and what technology can change and does change. Moreover, observing absolutely no change as a result of new and widespread technology is of particular interest; it would suggest that political processes are profoundly sticky and immune to innovation and changes in some daily behaviors by citizens. The use of the Twitter service is increasing exponentially and shows no immediate signs of tapering off. In short, citizens and elites are flocking to a new technology, and political scientists have, at this point in time, a limited understanding of what it means.

A number of scholars have begun to explore its impact on the American political process, with mixed results (Golbeck, Grimes and Rogers 2010; Lassen and Brown 2010). Congressional use of Twitter in particular has been explored in depth, but with little variance in the institution, there is little understanding of the role of institutional factors in determining how legislators use Twitter. Many content analyses of tweets by both political officials and ordinary people have pointed out that a large portion of tweets are about content that appears mostly meaningless, or as one study described it, "pointless babble" (*Twitter Study – 2009* 2009). From what political science has come to know about legislator behavior, there is little that they say or do that is without meaning and implications. Scholars of political identification also focus on the audience of a message. While there has been much research into the role of the medium and an audience into a message, there has been less with regard to how these two elements interact, especially with regard to filtering. There is also little understood about the unique features of Twitter, and the implications of them in both political science and politics.

In light of this research problem, I discuss and explain a number of theories that describe

why and how state legislators use Twitter. This is one small piece of a larger research problem, but it seeks to address the particular concern of what goals legislators have in using Twitter, and how to better understand and measure this concept over time. Particularly, I theorize that legislative public communication as a function of re-election motivation conditioning a number of factors that affect the decision of a legislator to use Twitter, and the content of an individual legislator's tweets. I also expect that the low cost of Twitter messaging conditions this as well. I also view the supposedly "meaningless" messages that dominate the Twitter landscape as fundamentally important to legislator behavior; they are key elements of "home style," an attempt to convince their constituents that they are just like their constituents, and that they understand the concerns of their constituents. I develop and discuss a new coding scheme for legislator tweets which helps to better understand the dynamic of the service, and helps to test a number of theories related to the public communication of state legislators. I test adoption of Twitter using a legislator-wide model and a random sample of legislators, as well as a model that tests whether twitter use is conditioned on the audience of the legislator's account.

Developing a theory of technological adoption by legislators requires that we consider the technology itself. Not all new technologies are the same, nor is their adoption. For example, the states with the five highest concentration of legislators using Twitter are not among the five states with the highest concentration of legislators using Facebook (Hoffman 2011). I chose to study Twitter for several reasons related to its relatively strict rules, observable nature, and public space. Twitter restricts all posts to 140 characters or less, restricting the information that can be presented in a single tweet and reducing the cost of using the service. Twitter allows users to "retweet" a message by another user, and tracks the number of retweets as well, displaying the diffusion of a message across the service. Twitter users can also use hashtags, a common tag that joins together a series of messages around a particular topic. The service also allows users to reference other users in their messages, and directly reply to tweets that mention them. All of this activity takes part in what is essentially a public space. Twitter has also expanded access to its application programming interface, allowing a wide variety of electronic devices services to access and post messages. Some entrepreneurial developers have even developed emergency and panic buttons that post messages to Twitter when the user is in distress.¹

The structure and rules of Twitter have implications for its use. The design of the service has the effect of drastically reducing the cost of use; a Twitter user can write a tweet in an extremely short period of time. Unlike other popular technological services, Twitter is not dominated by the white, educated, and young (Smith 2011). This short, succinct messaging may also be relevant

¹ The `twitteR` package in R is particularly useful, it integrates the statistical software with the Twitter application programming interface.

to what has been understood about political information processing, that short messages with little nuance and substance are the easiest for most citizens to absorb (Ferejohn and Kuklinski 1990). Twitter also follows a time-series progression in most services - almost all users view their Twitter account in order of most recent to least recent; there are no algorithms that find “popular posts” or things that are conditioned on how a user views the service (a new development for Facebook). As a result, two Twitter users who follow the same accounts generally see the same display of messages in the service, making the user experience easier to assess and measure outside of an experimental setting.

State legislatures play an important role in studying these processes. Previous research indicates that state legislators are ambitious and those that are seek to attune themselves to citizen opinion in order to secure re-election and advance their careers beyond their current position (Maestas 2003). Comparing state legislatures also offers the advantage of institutional variation; states vary in how professional they are (Squire 2000), their party structures (Wright and Schaffner 2002), the mapping of their party ideologies (Shor, Berry and McCarty 2010), the structure of their elections (Jewell 1994), and the organization of their interest group communities (Lowery and Gray 1995). Leveraging the methods of comparative politics within the American states enables analysis that can examine how the conditions of the institution contribute to overall behavior.

Re-examining Fenno’s 1978 work at the state level and through a new medium is important in leveraging the variation in state legislators to better explain legislator behavior.² This method allows us to examine homestyle elements in the context of the body in which legislators operate. The latent principle of “Home Style” is the idea that members of Congress cultivate a different personal style when they return to their constituencies as opposed to when they are in the Capitol, an assignment of meaning to place. The nature of variation amongst state legislatures is such that a legislator may use different tools to present themselves to constituents based on the number of constituents they represent, and the resources provided to them. For example, a California state senator represents nearly 200,000 more people than the typical member of Congress; at the same time, a New Hampshire state representative represents barely more than 4,000 individuals.

Economic Theories of Legislator Behavior

Much of the theory surrounding the actions of legislators has been economic in the sense that it evaluates behavior in terms of the costs of a specific behavior to a legislator, the benefits of

² For an excellent examination of legislator use of Web pages, see Adler, Gent and Overmeyer 1998.

the particular action, and the resources available to the legislator to conduct such behavior. It is important to think of technology adoption in general and Twitter adoption in the context of these economic theories. These theories generally view legislators as utility maximizers; unwilling to take an action if it is not the most efficient way to use their resources to accomplish their goals. At both the individual and the state level, scholars have found great variance in the goals of legislators, the resources available to them, and the benefits of various behaviors within and between states. Here, I discuss some of these theories, with particular attention to how they impact expectations of whether or not legislators choose to use Twitter, or not.

The core of my theory is based in the idea that legislators, particularly in the way that they communicate publicly, are single-minded seekers of re-election (Mayhew 1974). While Mayhew discussed the United States Congress in particular, these tenets should hold true for state legislators as well. The three areas of behavior that Mayhew describes are all communication behaviors: advertising, credit-claiming, and position taking are all public actions that relate to a re-election motivated relationship between citizens and legislators. It is clear that Mayhew's considerations of all Congressional action is incomplete; further work has shown the importance of policy and party (Aldrich 1995). The re-election framework, however, explains almost all public communication by legislators, and we should expect both the decision by a legislator to use Twitter or not, as well as what they tweet about.

Furthering the economic consideration of Twitter is an extremely low-cost activity for state legislators and other elected officials. Many officials tweet themselves, while others have staff to handle the account (Golbeck, Grimes and Rogers 2010). Some users tweet frequently, while others do not. In a perfectly efficient system, the choice to use Twitter (and the content of a legislator's tweets) would be purely a function of its value in securing re-election. If it had no use for advertising, credit-claiming, and position-taking, legislators would simply choose not to use it. Technology adoption, within this framework, is a competitive edge utilized by legislators to enhance their ability to be re-elected. This is not to say that challengers cannot sign up and use Twitter accounts. Rather, it is to say that the inherent advantages provided to incumbents can enhance the power of technology. As a result, I consider innovation as an important element in this process. This adoption of technology by legislators should be considered a product of re-election motivations expressed through institutional, constituency, and personal expectations.

I chose to analyze state legislatures to capitalize on the variance in institutional rules and norms that they offer; thus it is important to consider that Twitter behavior should be conditioned by the institution where the legislator resides. Legislators may choose to tweet because it is expected of a member of their legislature, chamber, or party, considered necessary for re-election by members of a party campaign structure, or be related to the resources that they

are provided as a member of the institution. While states have different rules and norms, the conditions of these rules and norms should affect why and how state legislators use Twitter.

Legislators may also choose Twitter as a re-election tool as a function of representing their constituency. Recent studies have shown greater adoption and use of the service amongst people of color and the young. There may also simply be more Twitter users within a particular district. The use of Twitter may be a contemporary expression of what Fenno (1978) described as “Home Style,” an effort by legislators to highlight themselves as everyday folks, and part of the community that they represent. Fenno identifies three key elements of self-presentation by legislators: qualification, identification, and empathy. In a more digitized democracy.³ This particular notion is discussed further in the paper as an avenue for measuring and better understanding seemingly innocuous behavior in how elected officials use a limited messaging service.

Finally, legislators are not merely representative automatons. They are human beings in a human institution, and their actions may be motivated simply by who they are, rather than the chamber they occupy or constituency they represent. While some legislators may descriptively represent their constituents, others may not (Lublin 1997). A legislator who adopts Twitter purely as a result of personal characteristics would still be primarily concerned with re-election, and engage in re-election seeking behavior via Twitter not because of the demands of the institution or their constituency, but because they themselves have an affinity for using technology outside of their duties as a legislator.

There is also some evidence that younger generations of people can better absorb and understand new technologies, as methods of learning have changed to focus heavily on programming, computer systems, and interaction with machines. Most Americans born after 1980 have used a computer on a regular basis for almost as long as they were functionally literate (Palfrey and Gasser 2010). These so-called “digital natives.” seem to have lower costs for using new technologies, and are able to adapt more quickly to changing technological trends and understand the functionality of both the internet and its applications in a way that is not usual for the population at large. This consideration may layer onto legislator behavior; a younger legislator may be more at ease utilizing a new technology for these purposes, and at the same time, legislators with larger staffs, presumably made up of at least one young person, could also maintain an active Twitter presence.

³ For competing views on the role of the internet in democratic discourse, see (Mossberger, Tolbert and McNeal 2008) and (Hindman 2010).

Bounded Rationality and Technology Adoption

The decision to adopt Twitter and how to use it by legislators is a process of parallel innovation. Legislators are responding to the behavior of their constituents, while at the same time, constituents are finding new ways of receiving messages from legislators and interacting with them. Any innovative process that follows a perfectly rational choice model should be considered suspect, especially with regard to political behavior. It is important to note that bounded rationality plays an important role in the behavior of governments (Jones 2001) and the adoption of technology, even famously, to the keyboard (David 1985). Repeated patterns in human behavior, and in particular, government behavior, show some random models of adoption, that is to say, that the most rational decision is not the one that is made by the government. Legislators are both individual human beings and also representatives tasked with government; in both cases, we should expect their ability to make perfectly rational choices in adopting technology to be hampered by cognitive limits. I condition my theory of technology adoption on two key elements well researched in the bounded rationality literature: the concepts of *incomplete information* and *sticky behavior*. These conditions serve as comparative statics; this paper is designed to clarify the theoretical underpinnings of technology adoption. My theory views bounded rationality as an important strain in understanding the development and use of Twitter by state legislators.

Assuming perfect information for legislators with regard to technology is unrealistic to the point that evaluating theories based on perfect or near-perfect information by legislators becomes difficult to justify as externally valid. The application of an incomplete information assumption in this case is particularly valid. Twitter is a relatively new innovation, and if the history of the use of political web pages is any indication, the way that technology is utilized in an election by candidates and by voters has changed over time (Norris 2003; Druckman, Kifer and Parkin 2007). This example displays a process whereby both officials seeking re-election and voters are innovating in parallel; candidates are changing the way they are transmitting messages, and voters are changing the way they use websites to get information about candidates. This model of innovation makes the information environment highly volatile. Innovative legislators may be essentially acting without an understanding of how Twitter will boost their re-election chances, but rather, they have expectations one way or the other that are not grounded in clear evidence.

The concept of imperfect information is closely related to that of limited adaptation, or *sticky behavior*. Just as markets do not respond perfectly to changes, neither do humans. The concept is simple, and echoes through the social sciences. Human beings, given a choice between this status quo and change, are far more likely to choose the status quo, as they are particularly inefficient in adapting to change (March 1994). The operation of this principle is particularly clear in

the development of political campaign activities. Despite overwhelming evidence regarding the efficiency and inefficiency of particular campaign tactics (Gerber and Green 2000), incumbents frequently rely on campaign techniques that are ineffective. In all but a few cases, incumbents are unwilling to change even the most basic behaviors, even in the face of overwhelming evidence to the contrary (Issenberg 2011). In short, even in the face of large amounts of information, legislators are set in their ways.

Combined with the literature on the generational costs in technology adoption, these bounds on a rational model suggest that technology adoption and use will not correlate with re-election expectations, or particularly advantageous legislator behavior. Technology occupies a special place in terms of behavior; it is by definition, a change that is gradual, to the point of not requiring adaptation. At the same time, technology can spur innovative behavior, but this innovation is hampered by both the costs of technology, the lack of information, and the inherent general inefficient adaptability of human beings. All technologies face these issues, but Twitter may have features that counters this resistance.

No scholar could successfully argue that Twitter is one of the most important things a legislator does. Rather, it is a communications medium, a conduit for the activities of a legislator. To choose to use this technology for their official duties is a conscious choice, but one that may not necessarily be the most obvious choice. While the costs of using Twitter are low compared to other technological products used for political communication, it is important to be mindful that even a low cost action may have barriers that are not inherent in its costs.

In a model of technology adoption, we may be observing a period that has high fluctuations in results. Indeed, of the few studies of Twitter adoption by the United States Congress, both found conflicting results as to why members of Congress chose to sign up for Twitter accounts and how they chose to use them (Golbeck, Grimes and Rogers 2010; Lassen and Brown 2010). Very little is understood about what happens at the beginning of an innovation and its use by legislators. Twitter adoption patterns do not follow traditional models of technology adoption, and therefore, may not be similar to the use of websites by legislators. The entire process is somewhat noisy, and therefore inconclusive results may be expected.

If a bird tweets in a forest...?

Of course, the idea of measuring whether legislators are tweeting is not particularly interesting without considering what legislators are attempting to accomplish with a new medium. Grimmer Grimmer (2009) used the press releases of United States Senators to measure the nature and character of legislator home styles in the twenty-first century. It is important when

attempting to quantify a latent concept to consider its mechanics. Theories of media agenda setting and framing, as well as filtering, help us to better understand the nature of home styles generated by legislators in the contemporary era. Home styles are by their very nature elusive to empirical investigation; it is a reflection of a series of cues, many unspoken, in the course of a legislator's public dialogue with his or her constituents. In attempting to measure this concept, it is important to be cautious.

Here, working theories of legislator communication are helpful in understanding how legislators communicate with their constituents. Media can act as a filter for communication, but trust is difficult to convey through mass media. In addition, legislators may attempt to cultivate trust through political elites, who through their own networks, influence the preferences and opinions of others. This means of building trust is easier, but it tends to reflect the politically sophisticated nature of political elites; there is more policy content, and while it still contains personal elements, it is demonstrably different from what Fenno 1978 described. The flexible nature of the audience is also key to understanding legislator communication; one would expect that a legislator speaking to a larger audience would have a more homogeneously appealing message, with broader themes, more valence, and less policy content.

Twitter, by its structure and norms, is a medium particularly suited to home style messages. The short format of the messaging service encourages users to be brief, communicating a complex concept in as tight a package as possible. When members of Congress tweet, it is usually controlled by staff, and contains, essentially, a link to a press release or comments. However, in the few notable cases where members of Congress are known to use their official Twitter accounts primarily on their own, or with staff assistance as opposed to control, far less content appears in this manner (Golbeck, Grimes and Rogers 2010). Given its low cost of access and use, many users (legislator and otherwise) tweet on at least a daily basis, if not more often. This bulk of information, in small 140-character bites, makes it easier for legislators to include identification, empathy, and qualification messages along with policy and constituent service content. The audience for a legislator's tweets is extremely important in understanding the motivations of the legislator's message. With a large enough group of followers, some officials, primarily at the local level, have used Twitter to negotiate responses to constituent service requests. Others have held "virtual town halls" to answer questions from citizens. These cases are exceptional, however. What I am most concerned with is the image of trust cultivated by legislators directly through their constituents.

Data, Expectations, and Methods

I examine Twitter adoption and use in three contexts: the adoption within a state population of legislators, and individual-level model of behavior with mixed state-level effects. I also extend a content analysis method by Golbeck 2010 to examine the relationship between audience and home style messaging. I use a variety of methods to help isolate particular effects in these models, including OLS regression, random-effects modeling, and content analysis. Each of the models is designed to test an element of the same set of the larger research question: how do state legislators adopt and use Twitter for representation purposes?

State-Level Evaluation

These institutional, constituency, and personal offshoots are not independent of each other, but compose three distinct elements of a multifaceted process that drives technology adoption. From these processes, I offer the following expectations as to how they will affect whether and how state legislators use Twitter to communicate with their constituents. The more pressure a legislator receives from an institution, the more likely they are to use Twitter. Constituency factors should also drive the decision to tweet and the content of a legislator's tweets. Simply put, the more likely citizens in a given district are to use Twitter, the more likely a legislator is to use Twitter. In this case, there should be a particular dominance of issue and credit claiming content, especially in terms of allocation to district. Controlling for these other factors, a legislator should be more likely to use Twitter if they as an individual, normal, non-legislator are likely to use Twitter. In these cases, I expect to observe a lot of both "home style" tweets, as well as direct constituent service, where a legislator would directly respond to constituent concerns.

As mentioned previously, It is also important to note that a period of adoption and innovation in communication is both highly volatile, and highly frictional. Legislators are, along with the rest of the democratic system (and those who study it) still working out how they can utilize such technology. There is no clear defined path or strategy to observe optimum results. There is also the possibility that people are using technology merely because it is technology, using the same kinds of messages on Twitter as they are in press releases. As an example, political actors have been roundly criticized for treating the internet as merely a new way to raise money (Armstrong, Rosenberg and Zúniga 2007), as opposed to utilizing the unique features of a new medium to better interact with citizens. In this transitional period, I expect to see highly variant behavior, that in terms of impact of statistical analysis, may show no discernible pattern.

My state-level method of estimation is a Ordinary Least Squares model that uses the propor-

tion of legislators with active Twitter accounts within a state as a dependent variable. This data was obtained from the legislative contact data company KnowWho, inc., a leading provider of legislator contact information to interest groups, and the various technology vendors who service them.⁴ Twitter proportion is a better measure than the raw count, as it is a measure of saturation within a state legislature, and controls for the varying combined legislature sizes between states. In measuring adoption within states, a better picture of state variation in adoption is presented, as the data has a substantial range across all fifty states.

A number of representation measures were calculated at the state level. The percentage African American population was garnered from the 2010 U.S. Census, as well as the percentage population over age sixty-five. These measures both reflect the likelihood of a state to have a large population likely to be currently using Twitter or to adopt it in the near future. I expect that, considering the age gap in Twitter usage, states with a smaller under 65 population will have a greater proportion of legislators using Twitter. While it is not tested here, I identify this action, at this time, as an attempt by innovative legislators to better communicate with constituents. The percentage of state citizens using Twitter, obtained through the Twitter marketing service Twellow.com,⁵ , is used to control for the current population of twitter users in the state. This controls for the effects of using Twitter overall, and allows the model to evaluate the independent effects of black population and elderly population on the state population. There may be a high degree of collinearity between these three variables, but their independent effects are my primary concern in the model. All of the representation measures – percent black population, percent over age sixty-five population, and percent of state population using twitter – are complete for all fifty states.

As measures of institutional pressure, I chose legislative professionalism, as measured by Squire (2007)⁶ , and folded one year legislative party competition measure, based on Carl Klarner’s predictions of legislative party control⁷ . Legislative professionalism serves several

⁴ While KnowWho is the most prominent provider of legislative contact information, its data on the United States Congress is generally more accurate than its state legislator information. In gathering the sample for the individual dataset, I found a number of twitter accounts that were not counted in KnowWho’s dataset. However, there appears to be no inherent bias in KnowWho’s data, and their information, if slightly outdated, appears consistently so.

⁵ While Twellow is a marketing service and may over-inflate their numbers of twitter users within states, a number of researchers have used them previously, as there are no viable alternative sources of this information. If there is bias in this data, it appears consistent across all fifty states.

⁶ The legislative professionalism literature is vast, and it is important to note here that legislative professionalism soaks up a large amount of explanatory power in models. It is the supply side of any economic model, as it reflects the resources at a legislator’s disposal. It incorporates a number of elements, such as the pay scale for a legislator, the staff and office resources distributed to them, and the number of days they spend in session

⁷ Though some evidence shows that Klarner’s measure on the whole is strongly correlated with the Ranney index in some years, these folded measures reflect a theoretically stronger measure of intraparty competition, as it assesses the electoral dynamics of the state legislature rather than the policy outcomes of party control. This construct is preferable here, as my theory is centered around re-election motivations. My measure averages Klarner’s 9-month control probability measure across both houses within each state, and is then folded in the same manner as the Ranney index to convert a party control measure to a party competition measure.

theoretical purposes. It reflects the supply of resources available to the typical legislator within a state. It also increases the likelihood that a legislator will have access to staff, many of whom may be considered “digital natives.” Further, it may work to overcome the bounded rationality constraints on technological innovation, as it gives legislators both more time and more resources to do their jobs. With these expectations in mind, I expect legislative professionalism to be positively correlated with higher proportional state legislative twitter usage. The legislative party competition measure generally reflects the political climate within the legislature; in more competitive legislative environments, I expect there to be more legislators seeking to communicate with constituents directly and through a media filter; as a result, they would be more likely to adopt and maintain Twitter accounts. Data for legislative professionalism was available for all fifty states, and is the most recently-issued measure by Squire. The legislative party competition measure was calculated for all states with the exception of Nebraska. Given the theoretically important nature of Nebraska as having a non-partisan legislature, and that its voting structures do not necessarily conform to those of a similar state (Wright and Schaffner 2002), imputing a value for Nebraska is unwarranted. The model estimates using case-wise deletion. While case-wise deletion can bias results (Little and Rubin 2002), in this case, it is the most theoretically sound decision, given that the absence of Nebraska’s measure is related to variables not included in the dataset.

Individual-level Evaluation

It is also necessary to measure Twitter adoption at the individual level. While the previous model measures adoption within institutions, and capitalizes on the variation across states, an individual level analysis is needed to assess the adoption process for individual legislators acting within states. Because the individual-level model includes both individual and state-level variables, a more complicated model, using modeled coefficients, is utilized. The individual measure also gives a better picture of the particular strains and resources on the legislator, as well as those generated from the institution.

Following the statewide model, I constructed an individual-level model using a random sample of 250 legislators, culled from a repeated sample of each of the fifty states. In this model, the dependent variable is whether or not the legislator has a verified Twitter account. I gathered this variable through a methodical searching of candidate websites, public candidate statements, searches of legislative information databases, and the Twitter automated processing interface.⁸ Based on the expectations from the state-level model, I incorporated the state-level variables of

⁸ To establish a research bright line, searches of the legislator’s name were conducted on <http://www.wikipedia.com>, <http://www.ballotpedia.com>, and twitter.com for the candidate’s name and state. A twitter account profile must list the account as belonging to a state legislator.

percent black population, percent of statewide twitter users, legislative professionalism, legislative competition, and percent of population over age sixty-five as variables in the model. The increased sample size allows us to incorporate both individual and state-level variables, while controlling for random effects. I expect all previous expectations for the state level variables to hold in the individual level model.

The individual variables I examine reflect both the personal characteristics of the legislator as well as the political dynamics that surround them. Age as a function of the birth year of legislator subtracted from the year the data was gathered year is evaluated as a linear effect in the model.⁹ Based on both the rational aspects of the model of technology adoption, and the bounded constraints of those rationality assumptions, age is an important factor. The inherent costs of adoption should increase for age over time, meaning that as age increases, the probability of using Twitter decreases. Based on the work of Lublin 1997, we would expect members of legislative black caucuses to seek to communicate with and represent members of their community descriptively. Just as the population of a state would take into account the population of legislators, race is an important factor at the individual level as well. A binary variable was gathered and coded as to whether the legislator was a member of a legislative black caucus. The legislator’s party affiliation, collected from official sources, was also collected. Of the 250 state legislators in the sample, 226 have complete data. The most common missing variable was age, as many legislators do not publicize their year of birth. While age is a commonly imputed missing variable in social science survey data, there were not enough other observed variables to properly impute this information.

To estimate the effects of the state and individual variables on a state legislator’s adoption of Twitter, I used a multilevel or “random effects” logistic regression model with both individual and group predictors, best explained by Gelman and Hill (2007). This model allows interpretation of both the state-level and individual-level effects on a latently individual process (the decision to use Twitter) at the same time. In this particular case, the model includes individual-level predictors, state level predictors, and intercepts that vary by state.

Content Analysis of Tweets

A core problem of content analysis is the development of an objective coding scheme to code subjective content with subjective human coders. At the same time, it is necessary to give each category meaning. The best effort possible was examined to develop a method that is relatively

⁹ Age is an important factor to consider in any model. A number of other models using parabolic or logarithmic scaling of age, as well as a “digital native” dummy variable for legislators were also calculated for investigative purposes, but are not included.

easy to both test, use and reproduce. This subsection details a coding scheme that helps to objectively quantify Twitter activity, with particular attention to theoretical concerns in political science. When a legislator does something publicly, especially say, sending a public message, I assume that it has some kind of meaning or purpose related to their motivations as a legislator. This assessment stands in direct contrast to previous content analysis of legislator measures of members of Congress. While it is possible that state legislators are tweeting with absolutely no regard to representation and re-election, it seems, given the breadth of what political scientists have found about legislator behavior, to be highly unlikely, given the very public nature of the medium (as an example, I found no state legislator’s Twitter account, in the exploratory, data-gathering, or analysis phases of this research work that is private or permissioned).

Twitter returns a certain amount of metadata with each tweet than can be retrieved from the Twitter automatic programming interface. This includes the time of the tweet, the screen name and ID of the user who the tweet was in reply to (if it was indeed a reply), the “source” or program used to post the tweet (on Twitter, this is the information that comes after the word “via,” displayed in the tweet), the time the tweet was posted, whether the tweet was truncated, and whether the tweet was favorited by any user. All of this information is provided to analysts, so there is no need to layer information that would overlap this data. However, this pre-packaged metadata is particularly useful to the coding scheme.

First, I created a content variable to characterize the nature of the tweets. Some of these categories parallel the work of Golbeck, Grimes and Rogers (2010), but there are noticeable differences, particularly in how some content is characterized. The primary variable is unordered and categorical, and describes the primary category of the content of the twitter message. Informational content is that which encourages the user to visit a link, and contains what is essentially the title or headline of an article. This may include a wide variety of information, but this variance is not particularly relevant to the code, as the messages asks the reader to go outside of the Twitter service. Policy content is a statement about a specific bill, policy position, or other statement that discusses policy matters. One should be able to make a judgement (if not a particularly nuanced one) about the legislator’s policy position from policy related tweets. Allocation content codes for statements about returning funding to the district. Constituent service tweets refer to content that deals with service issues rather than policies; for example, providing resources for people to report downed trees during a severe weather event. These resources may be state, federal, or local, but reflect credit claiming. A tweet is coded as “service” if it describes a resource available to constituents, refers a constituent to an agency, or provides information for constituents about government service. Finally, Home style content may not fit into any of the following categories, but must include at least one home style element, as described below.

I also included a category for uncodeable content as well, to reflect the nature of twitter as a medium that can be somewhat difficult to interpret. These categories are evaluated numerically, but are categorical and unordered.

It is also important to code a binary variable for interactions with other Twitter users as well. In addition to this binary variable, I include a series of binary variables as to whether the user referenced in the tweet is a constituent, a member of the media, an elected official from their own party, or an elected official from another party. This set of variables is designed to capture the messaging and interactive features of Twitter. These elements are not well explored in other literature, and are important to understanding how users of the service capitalize on its features. The interactions of Twitter users are essential to measure in terms of understanding how the communication service functions and how its users behave.

Finally, in an attempt to quantify a concept of “Home Style” for this medium, I include a binary variable for whether or not the tweet mentions a location in the legislator’s district, and a binary variable if the tweet is geo-coded within the legislator’s district. Both of these behaviors seek to convey to a legislator’s Twitter followers the activities they undertake within their districts and their normal activities. These measures seek to capitalize on two key understandings of previous literature regarding Twitter and regarding legislator behavior. First, that the vast majority of tweets convey everyday information, the essence of what is called “The Daily Me” (Lasica 2002). Second, that in their official capacity, there is little that elected officials do that is unmotivated by their desire to remain in office. Thus, in examining how state legislators tweet, it is important to examine their actions as meaningful, even when on face, the content of their messages appear innocuous. I created separate binary variables for “qualification,” “identification,” and “empathy” messages as well, reflecting the concepts of presentation of self in Fenno’s original work.

From the previous sample of legislators, I generated a population of their entire Twitter histories, also known as a user timeline. I combined each timeline into a single large dataset of tweets, and generated a random sample of 500 tweets from the full dataset. This sampling should avoid too much duplication of the same twitter account, but more frequent Twitter users tend to be over-represented in the sample. To model the content of tweets, I use an unordered multinomial logistic regression model, using audience as the explanatory variable of interest. Audience is calculated as the legislator’s number of Twitter followers at the time of the tweet. In general, I expect a larger audience to be more highly associated with “home-style” tweets, and a smaller audience to be associated with more press-release and policy-style messages, as one would expect in communication with media or activists.¹⁰

¹⁰ This sampling procedure is not necessarily a random sample of all legislators or all legislators who tweet.

For the evaluation of the content of Twitter messages, I expect the follower count to have statistically significant effect on all of the content categories. The number of followers a legislator has is their audience, and though all of the tweets in the message came from public Twitter accounts, I expect content to vary based on audience. Specifically, a legislator will use more home style messaging as their audience grows, and be less likely to use informational content. I also expect that the independent effect of professional, well-staffed legislatures in a model will have a positive effect on the likelihood of home-style messaging, as staff members are less likely to convey personal messages, but rather tend to use Twitter as a press release engine.

Given the large variance in the number of tweets a given legislator may have in their history, there is almost certainly a bias in the sample towards legislators who tweet more often.

Results

Table 1: OLS Results of State Population Model

	Model 1	Model 2
(Intercept)	-0.01 (0.96)	-0.00 (0.97)
Pct Twitter Users	0.12 (0.45)	0.03 (0.83)
Leg. Professionalism	0.42* (0.00)	
Pct. Black Population	-0.04 (0.75)	-0.03 (0.80)
Leg. Party Competition	-0.20 (0.13)	-0.15 (0.29)
Legislative Pay		0.01 (0.95)
Leg. Session Days		0.10 (0.56)
Legislative Staff		0.44* (0.03)
N	49	49
R^2	0.24	0.28
adj. R^2	0.17	0.17
Resid. sd	0.92	0.92

¹ Bootstrapped p values in parentheses

² * indicates significance at $p < 0.05$

³ Coefficients Standardized

Table 1 displays the results of the state-level model of Twitter usage populations in the state. Given that the range of possible values for legislative party competition does not include zero, it is not possible to interpret the intercept in this model. When state twitter usage, legislative professionalism, and percent black population is regressed on Legislative professionalism is the only statistically significant predictor of proportion of legislators using Twitter at the $p < .05$ level. Even then, the average effect is substantially rather small. On average, controlling for

the effects of the other explanatory variables in the model, the effect of one standard deviation increase in legislative professionalism on the percentage of legislators using Twitter is approximately 0.42 standard deviations. While this effect is positive and statistically significant in the model, the regression coefficients for the other explanatory variables in the model are not statistically significant at the $p < .05$ level.

Model 2 seeks to unpack the effects of each of the elements of Squire's legislative professionalism measure. When split into legislative pay, days in legislative session, and legislator staff, the legislative staff measure is the only staff variable is statistically significant at the $p < .05$ level. This would suggest that the staff component of the legislative professionalism measure seems to hold a most of the explanatory power of the legislative professionalism measure in model 1. In model 2, controlling for the effects of the other explanatory variables in the model, the average effect of a 1 standard deviation increase in staff (about 12 percentage points, or 4 staffers) on the percentage of the state legislature using twitter is approximately .42 standard deviations, or about 5.88 percentage points.

Also revealing is the relatively low level of model fit. Despite the inclusion of a variety of state level predictors, with similar variance to the dependent variable, the level of R^2 is 0.24, meaning that the model predicts approximately 24 per cent of the variance in the dependent variable. This may reflect either the particularly noisy nature of the activity in the dependent variable, or improper selection of covariates for the model. Given that other attempts at modeling the dependent variable with other sets of predictors did not yield any improved results, it is unclear that the process of twitter adoption is stable enough to be modeled in this fashion.

Table 2: Logit Model, Random State Effects

(Intercept)	20.063*
	(5.249)
Legislative Professionalism	-1.108
	(2.525)
Logged State Twitter Use	2.219*
	(0.879)
Legislative Party Competition	-1.134
	(2.029)
State Percent Black	-0.061
	(0.035)
Age	-0.125*
	(0.021)
Republican	-0.353
	(0.437)
Black Caucus	1.058
	(0.808)
Last Vote Share	-2.167
	(1.161)
AIC	243.952
N	223

The Logit model, with “Random” state effects, that is to say, random intercepts for each state, shows the power of the group variables in the model. Table 2 shows the results of the model. In models such as these, statistical significance is not a good measure for the group predictors (Gelman and Hill 2007), given that the model allows the intercepts at each state to float and to be averaged over time. For the individual predictors, age is negative and statistically significant at the $p < .05$ level. Using the traditional “divide by four,” rule of thumb, in this model, age has a maximum effect of decreasing the probability of having a Twitter account by approximately 3.1% , meaning that a year increase in age corresponds to, at maximum, a .031 decrease in the probability of having an active Twitter account.

It is particularly troubling that the statistically significant explanatory variable in the first model does not appear to be statistically significant in the second model, and moreover, is signed negatively, in the opposite direction as the state population model. A number of factors may

explain this issue. First, the state population data was acquired prior to the individual sample data. Second, the sampling procedure¹¹ resulted in some states having a greater number of observations than others, which may weight the sample against professional states. There may also be measurement error; as an example, the state population data listed North Dakota and South Dakota as each having no members using Twitter; in the sample alone, I found one member of each legislature to have a Twitter account.

Table 3: Unordered Multinomial Logit Model of Primary Topic

	Policy	Allocation	Service	Home Style	Informational
(Intercept)	-1.99*	-1.04*	-4.28*	-2.50*	-2.17*
	(0.51)	(0.01)	(<0.01)	(0.52)	(0.48)
Follower Count	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Legislative Staff	2.61*	6.51*	-2.65*	0.08	3.21*
	(0.02)	(<0.01)	(<0.01)	(0.05)	(0.04)
Pct State Twitter Users	-49.03*	-18.70*	-5.23*	160.02*	-19.21*
	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
Age	0.04*	-0.02*	0.03	0.02*	0.06*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)

Standard Errors in Parenthesis

* indicates significance at $p < 0.05$

$N=374$

AIC=1017.49

The twitter coding process revealed several important descriptive findings. First, of the tweets sampled, nearly 16% were coded as home style content. This finding suggests that home style messages make up a substantial portion of those delivered via twitter, and in terms of electronic communication home style messages are the second most frequent messages of those codeable messages in the sample. Only informational tweets were more frequently found.

In table 3, the results of an unordered multinomial logistic regression are displayed. In a multinomial regression, the coefficients represent the log-odds of moving from the baseline level (general, uncodeable) to one of the respective categories for a 1 unit change in the respective explanatory variables. These results are easier to understand in terms of predicted probabilities,

¹¹ the sampling procedure is a random draw of 250 states, with replacement, followed by a random draw of legislative districts within the selected states

however, in almost all cases, predicted probabilities for the categories vary greatly across the distributions of the explanatory variables. This, along with a relatively high AIC, suggests again, a particularly noisy process within the model.

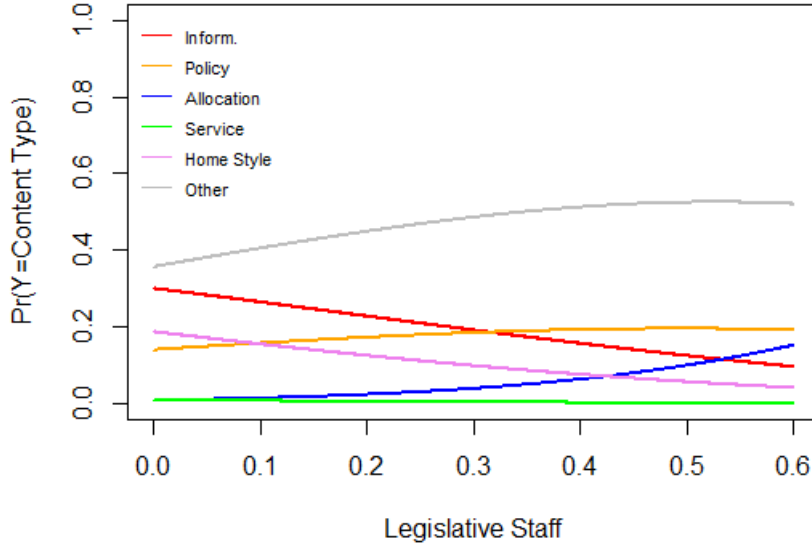


Fig. 1: Predicted Probabilities: Legislative Staff

Figure 1 shows a multinomial predicted probability plot for the model. While some conclusions are unclear, Both the probability of home style messages and informational messages decreases as staff funds become more professionalized. This graph displays the full range of the dataset, and does not include possible values above .60. These results contradict with information from previous studies, which show high rates of informational tweets by members of Congress. The increase in the predicted probability of tweets coded “other” may also indicate that legislators in more professional bodies use Twitter to communicate a wide variety of messages, which may not necessarily fit in the convenient bins developed in this study.

Discussion and Further Exploration

The results of this paper are promising for some better understanding of legislator use of technology as well as the implications for representation and future research attempting to quantify and measure home style communication. While typical predictors have been able to shed light on some of this behavior, it is clear that the process is still evolving. Only two of my original expectations emerged as more plausible in the course of empirical analysis. Nevertheless, this

study serves to better unpack how legislators choose to use a new communication medium.

This work gives more strength to the already robust literature regarding legislative professionalism. With more resources, it appears that legislators are exposed to more innovative environments, making it easier for them to adopt new means of technology to accomplish their goals. The empirical analysis also reveals a more robust role of age in adopting technology. While this finding is not unique, it is notable that the effects of age emerged clearly in a multivariate model. It is also notable that the given population is not all Americans, but rather a group of state legislators, who researchers have found, even in bodies that advertise themselves as “citizen legislatures,” to be remarkably different in terms of education, income, and ambition than the citizens they represent.

Descriptive analysis of the sample of legislator tweets offers a number of substantial, but cautious findings. At the time of the sample, the bulk of Twitter messages are informational, summaries of content found elsewhere on the internet, and link to articles, press releases, or official statements. This replicates content analyses of other means of public legislator communication (Grimmer 2009; Golbeck, Grimes and Rogers 2010). This suggests that Twitter is still a medium used by legislators as an extension of other communication mechanisms, traditional messages in a new medium. In contrast, the proliferation of home style messages in the sample suggests that Twitter’s format is conducive to home style messaging. It is not clear, however, whether legislators are targeting an audience with more home style messaging through this medium, or that the structure and norms of Twitter messaging results in more home style messages compared to other media.

The earlier expectations about the variance in audience size were found to have little support from the data I gathered and the analysis I conducted. Audience has an indeterminate effect on the content category of Twitter messages. Of all of the explanatory variables in the multinomial model, the audience variable had the smallest effect and was not statistically significant, suggesting that the size of a legislator’s Twitter audience has minimal effect on the content of their tweets. Audience size seems not to matter, but further research to examine the networks of legislator Twitter followers may offer more insight into the effects of audience (if any) on tweet content. Followers may also be an inaccurate measure of audience, as significant numbers of twitter accounts belong to spammers.

While the assertive findings of this work are limited, developing a method to better examine Twitter in the context of legislator behavior lays out a clear plan for future research and a number of interesting options for research inquiry. It is clear that Twitter usage is in a very volatile position in terms of its use as a political tool, and taking snapshots (as well as a thorough time

series analysis) of how this process evolves may reveal something more interesting than merely how politicians use a new social media service, a deeper understanding of how new technology is incorporated into a representative democratic system. This ultimate goal highlights and touches much of the model and method formation described above, with a particular goal to make these processes reproducible. The coding scheme can be easily applied to other short messages by other legislators and other elected officials.

Traditional models of legislator behavior seem to offer us little in terms of how legislators behave in adopting technology. In a perfectly rational model, this suggests that there is little benefit to legislators using Twitter for either representation or re-election purposes. However, technology adoption rarely follows a rational model. This seems to suggest that Twitter adoption for legislators is a statistically noisy process, just as it is for ordinary citizens. The strength of legislative professionalism seems to suggest the power of allotting resources to legislatures; legislators are likely to be familiar with computer systems, be comfortable using the internet in the course of their duties, and have staff willing to assist them in doing so.

Like many problems in scientific inquiry, more data is always helpful, particularly in this case. A small, and then larger randomized sample of legislators and their tweets will enable better testing of a complex model. The current data framework makes sense in terms of both existing theory and the measures and dynamics I wish to consider, but the model selection process will offer more information as to the quality of the model. It is also important to consider a two or three-stage model in evaluating this process. The processes that generate Twitter accounts for state legislators, a certain number of tweets, and the content of their tweets are all related, and are processes that should be modeled as such. In addition, examining the networks of legislators, media on the statehouse beat, and informed activists may also bring greater understanding to how legislators tweet in a dynamic environment.

Fenno (1978) is considered a classic work in political science, but there has been little effort to quantify the folksy, down home, just-one-of-you activities of elected officials, particularly state legislatures. Twitter and other social media are particularly oriented towards posts where the user describes a generally banal activity in which they are engaging. Developing a more complicated measure of in-district activity via Twitter would offer an interesting look into how legislators use a tool developed primarily for communicating day-to-day happenings to appear similar to constituents and their concerns. It is important to note that Twitter is a product of a society in which reputation on the internet is affecting everyday life to a greater extent than previously thought (Masum and Tovey Forthcoming), making people more concerned with how they are perceived through web applications, as well as suggesting that tweets about the minutiae of everyday life are important markers for establishing someone's reputation as normal

and relatable. Exploring these concepts through both institutional variation and a new media lens may offer a welcome twist on a classic work.

Finally, it is also important in examining these issues to consider that broad public communication also frequently has a target. This target may not be a constituent or voters, but instead media, influentials, or other filters who can be used to advance a legislator's message. From elementary observation, a good many of the followers of legislator Twitter accounts are reporters, bloggers, and online activists. The role of the media is an important one in citizen-legislator communication, and future work on these processes should take these considerations seriously.

APPENDIX

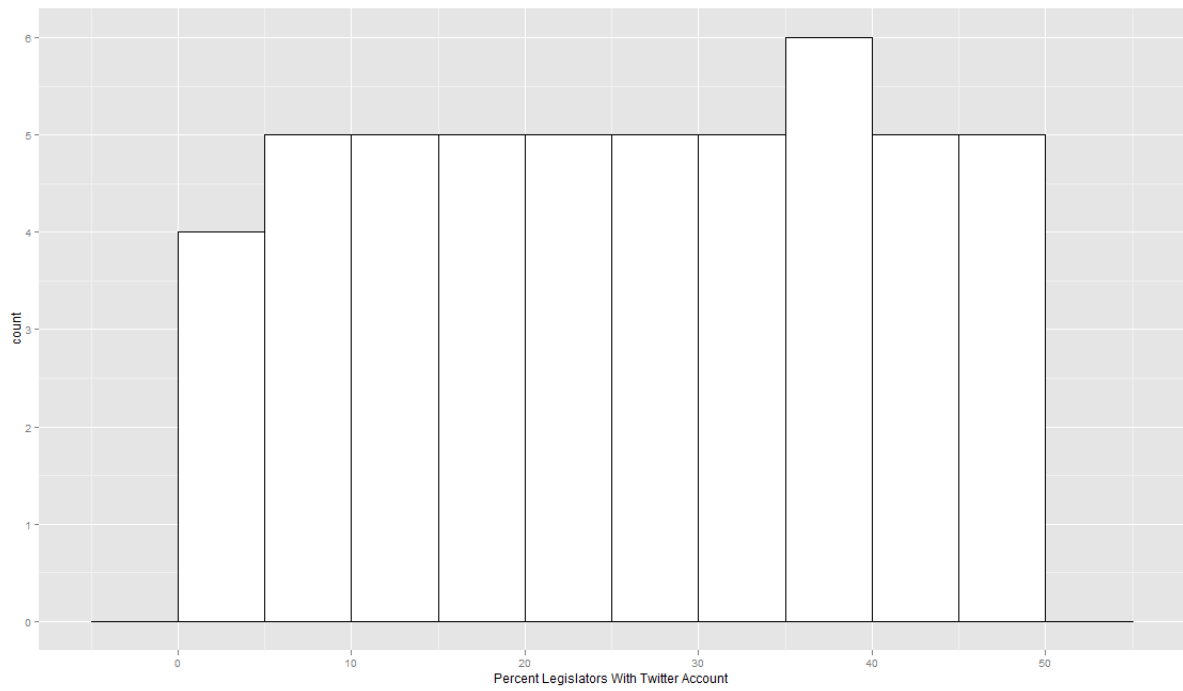


Fig. 2: Distribution of Pct Legislators with Twitter Account

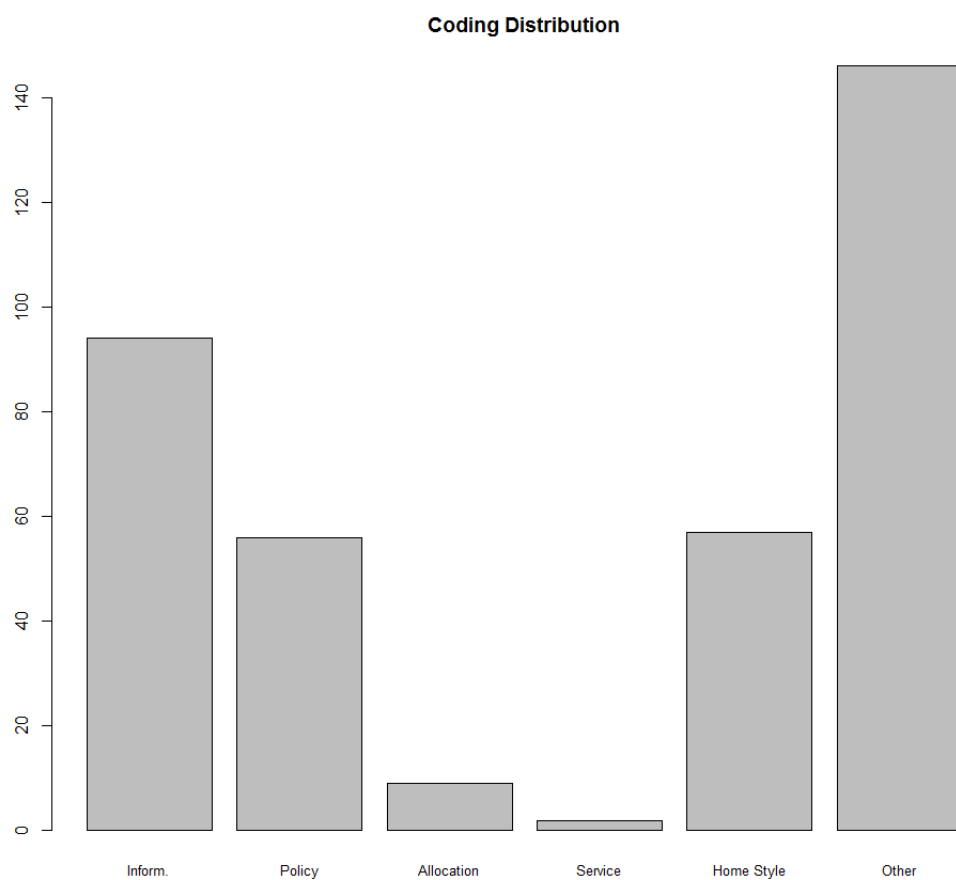


Fig. 3: Distribution of Tweet Content

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